



Al for Investment Analysis

機器人理財顧問與AI交談機器人 (Robo-Advisors and Al Chatbots)

1082AIIA03 MBA, IMTKU (M2399) (8409) (Spring 2020) Wed 3, 4 (10:10-12:00) (B206)



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http://mail. tku.edu.tw/myday/ 2020-03-18

課程大綱 (Syllabus)

週次(Week) 日期(Date) 內容(Subject/Topics)

- 1 2020/03/04 人工智慧投資分析課程介紹 (Course Orientation on AI for Investment Analysis)
- 2 2020/03/11 AI 金融科技: 金融服務創新應用 (AI in FinTech: Financial Services Innovation and Application)
- 3 2020/03/18 機器人理財顧問與AI交談機器人 (Robo-Advisors and Al Chatbots)
- 4 2020/03/25 投資心理學與行為財務學 (Investing Psychology and Behavioral Finance)
- 5 2020/04/01 財務金融事件研究法 (Event Studies in Finance)
- 6 2020/04/08 人工智慧投資分析個案研究 I (Case Study on Al for Investment Analysis I)

課程大綱 (Syllabus)

週次(Week) 日期(Date) 內容(Subject/Topics)

- 7 2020/04/15 Python AI投資分析基礎 (Foundations of AI Investment Analysis in Python)
- 8 2020/04/22 Python Pandas 量化投資分析 (Quantitative Investing with Pandas in Python)
- 9 2020/04/29 期中報告 (Midterm Project Report)
- 10 2020/05/06 Python Scikit-Learn 機器學習投資分析

(Machine Learning for Investment Analysis with Scikit-Learn In Python)

11 2020/05/13 TensorFlow 深度學習投資分析 I (Deep Learning for Investment Analysis with TensorFlow I)

12 2020/05/20 TensorFlow 深度學習投資分析 II (Deep Learning for Investment Analysis with TensorFlow II)

課程大綱 (Syllabus)

週次(Week) 日期(Date) 內容(Subject/Topics)

- 13 2020/05/27 人工智慧投資分析個案研究 ||
 - (Case Study on Artificial Intelligence for Investment Analysis II)
- 14 2020/06/03 TensorFlow 深度學習投資分析 III (Deep Learning for Investment Analysis with TensorFlow III)
- 15 2020/06/10 投資組合最佳化與程式交易 (Portfolio Optimization and Algorithmic Trading)
- 16 2020/06/17 期末報告 I (Final Project Presentation I)
- 17 2020/06/24 期末報告 II (Final Project Presentation II)
- 18 2020/07/01 教師彈性補充教學

Robo-Advisors and **Al Chatbots**

Outline

• Al Robo-Advisor in FinTech

• Al Chatbot for Conversational Commerce

Al Humanoid Robo-Advisor



AIWISFIN AI Conversational Robo-Advisor (人工智慧對話式理財機器人) First Place, InnoServe Awards 2018



https://www.youtube.com/watch?v=sEhmyoTXmGk

2018 The 23th International ICT Innovative Services Awards (InnoServe Awards 2018) InnoServe

- Annual ICT application competition held for university and college students
- The largest and the most significant contest in Taiwan.
- More than ten thousand teachers and students from over one hundred universities and colleges have participated in the Contest.

2018 International ICT Innovative Services Awards (InnoServe Awards 2018) (2018第23屆大專校院資訊應用服務創新競賽)



https://innoserve.tca.org.tw/award.aspx



IMTKU **Emotional Dialogue System** for **Short Text Conversation** at NTCIR-14 STC-3 (CECG) Task

NTCIR-14 Conference, June 10-13, 2019, Tokyo, Japan







IMTKU Textual Entailment System for Recognizing Inference in Text at NTCIR-9 RITE

Department of Information Management Tamkang University, Taiwan



Min-Yuh Day Chun Tu myday@mail.tku.edu.tw

NTCIR-9 Workshop, December 6-9, 2011, Tokyo, Japan







IMTKU Textual Entailment System for Recognizing Inference in Text at NTCIR-10 RITE-2

Department of Information Management Tamkang University, Taiwan



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Hou-Cheng Vong

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Shih-Wei Wu



Shih-Jhen Huang

NTCIR-10 Conference, June 18-21, 2013, Tokyo, Japan

IMTKU Textual Entailment System for Recognizing Inference in Text at NTCIR-11 RITE-VAL

Tamkang University



2014





Min-Yuh Day



Ya-Jung Wang



Che-Wei Hsu



En-Chun Tu



Huai-Wen Hsu



Yu-An Lin



Shang-Yu Wu



Yu-Hsuan Tai



Cheng-Chia Tsai

NTCIR-11 Conference, December 8-12, 2014, Tokyo, Japan



2016 **IMTKU Question Answering System for** World History Exams at NTCIR-12 QA Lab2

Department of Information Management Tamkang University, Taiwan

Sagacity Technolog



Min-Yuh Day Cheng-Chia Tsai Wei-Chun Chung Hsiu-Yuan Chang

Yue-Da Lin

Wei-Ming Chen

NTCIR

Yu-Ming Guo

Tzu-Jui Sun

Yuan-Jie Tsai





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NTCIR-12 Conference, June 7-10, 2016, Tokyo, Japan



2017





IMTKU Question Answering System for World History Exams at NTCIR-13 QALab-3

Department of Information Management

Tamkang University, Taiwan





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NTCIR-13 Conference, December 5-8, 2017, Tokyo, Japan











IMTKU Emotional Dialogue System for Short Text Conversation at NTCIR-14 STC-3 (CECG) Task

Department of Information Management Tamkang University, Taiwan







Chi-Sheng Hung







Yu-Ling Kuo



Jian-Ting Lin

myday@mail.tku.edu.tw NTCIR-14 Conference, June 10-13, 2019, Tokyo, Japan

Robo-Advisors

FinTech high-level classification



Source: Paolo Sironi (2016), "FinTech Innovation: From Robo-Advisors to Goal Based Investing and Gamification", Wiley. ¹⁹

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https://www.wealthfront.com/

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New investor

I'm new to investing, or am looking for some guidance.

Hands-off investor

I invest, but don't have the time or desire to do it myself.

https://www.betterment.com/

Hands-on investor

I'm a confident, hands-on investor looking for an optimal solution.

Financial Advisor FinTech Solutions

Financial Advisor FinTech Solutions Map



Source: https://www.kitces.com/fintechmap

From Algorithmic Trading to Personal Finance Bots: **41 Startups Bringing** Al to Fintech

Source: https://www.cbinsights.com/blog/artificial-intelligence-fintech-market-map-company-list/

From Algorithmic Trading To Personal Finance Bots: 41 Startups Bringing AI To Fintech Al in Fintech

41 Startups Bringing Artificial Intelligence To Fintech



Source: https://www.cbinsights.com/blog/artificial-intelligence-fintech-market-map-company-list/

Artificial Intelligence (AI) in Fintech









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Artificial Intelligence (AI) in Fintech



Source: https://www.cbinsights.com/blog/artificial-intelligence-fintech-market-map-company-list/

FinTech

Financial Technology FinTech

"providing financial services by making use of software and modern technology"

Financial

Services

Financial Services



Source: http://www.crackitt.com/7-reasons-why-your-fintech-startup-needs-visual-marketing/

FinTech: Financial Services Innovation



Source: http://www3.weforum.org/docs/WEF_The_future__of_financial_services.pdf

FinTech:

Financial Services Innovation

1. Payments 2. Insurance 3. Deposits & Lending 4. Capital Raising **5. Investment Management** 6. Market Provisioning

Source: http://www3.weforum.org/docs/WEF_The_future__of_financial_services.pdf

FinTech: Investment Management



FinTech: Market Provisioning



Source: http://www3.weforum.org/docs/WEF_The_future__of_financial_services.pdf

The New Alpha: 30+ Startups Providing Alternative Data For Sophisticated Investors

New sources of data mined by startups like Foursquare, Premise, and Orbital Insight are letting investors understand trends before they happen.

The New Alpha: 30+ Startups Providing Alternative Data For Sophisticated Investors

Alternative Data Sources



Source: https://www.cbinsights.com/blog/alternative-data-startups-market-map-company-list/
Al Chatbot for Conversational Commerce

Conversational Commerce

Chatbots: Evolution of UI/UX



Chatbot **Dialogue System** Intelligent Agent

Chatbot



Dialogue System



Source: Serban, I. V., Lowe, R., Charlin, L., & Pineau, J. (2015). A survey of available corpora for building data-driven dialogue systems. *arXiv* preprint arXiv:1512.05742.



Dialogue Subtasks

Browse > Natural Language Processing > Dialogue

Dialogue subtasks





machines

think?

(Alan Turing ,1950)

Source: Cahn, Jack. "CHATBOT: Architecture, Design, & Development." PhD diss., University of Pennsylvania, 2017.

Chatbot **"online human-computer** dialog system with natural language."

Source: Cahn, Jack. "CHATBOT: Architecture, Design, & Development." PhD diss., University of Pennsylvania, 2017.

Chatbot Conversation Framework



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From **E-Commerce** to **Conversational Commerce:** Chatbots and **Virtual Assistants**

Source: http://www.guided-selling.org/from-e-commerce-to-conversational-commerce/

Conversational Commerce: eBay AI Chatbots

••••• A	at 🗢 1:31 PM 💿 🕇 🖉 76% 🔳
< Hor	e Bay ShopBot > Manage
	I'm looking for adidas stan smith in white
ebay	Which gender are you looking for?
	Women
ebay	Sure, I've got a few options for those.
	Best Value
	View item
Ð	õ 🖾 🖞 🗛 🙂 🗐

Hotel Chatbot



An intent performs an action in response to natural language user

Utterances

Spoken or typed phrases that invoke your intent

Slots are input data required to fulfill the intent

Intent Detection

Slot Filling

Fulfillment

Fulfillment mechanism for your intent

H&M's Chatbot on Kik



Uber's Chatbot on Facebook's Messenger



Uber's chatbot on Facebook's messenger - one main benefit: it loads much faster than the Uber app

Source: http://www.guided-selling.org/from-e-commerce-to-conversational-commerce/

Savings Bot



	•							
Back	3:33 PM SAVINGSBOT	100%						
A new role \$9,500 How much do you want to save?								
1	2	3						
4	5	6						
7	8	9						
	0	×						
 Type a message 								
VIEW CREDIT	OPTIONS ASK	BUDGETBOT						
	\bigcirc							



Source: https://chatbotsmagazine.com/artificial-intelligence-ai-and-fintech-part-1-7cae1e67dc13

Mastercard Makes Commerce More Conversational







POWERED BY



Chatbots

Bot Maturity Model

Customers want to have simpler means to interact with businesses and

get faster response to a question or complaint.



Source: https://www.capgemini.com/2017/04/how-can-chatbots-meet-expectations-introducing-the-bot-maturity/

Bot Life Cycle and Platform Ecosystem

The Bot Lifecycle



The bot platform ecosystem and the emerging giants

Nearly every large software company has announced some sort of bot strategy in the last year. Here's a look at a handful of leading platforms that developers might use to send messages, interpret natural language, and deploy bots, with the emerging bot-ecosystem giants highlighted.



Source: https://www.oreilly.com/ideas/infographic-the-bot-platform-ecosystem



DESIGNED BY JON CIFUENTES

Bots Landscape





Connectors/ Shared Services



Bot Discovery



Analytics

Analytics

.....

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Al Tools: Natural Language Processing, Machine Learning, Speech & Voice Recognition







🕁 RECAST.AL Messenger Bot Landscape

May 2017

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Source: https://medium.com/@RecastAI/2017-messenger-bot-landscape-a-public-spreadsheet-gathering-1000-messenger-bots-f017fdb1448a /

How to Build Chatbots



Source: Igor Bobriakov (2018), https://activewizards.com/blog/a-comparative-analysis-of-chatbots-apis/

Chatbot Frameworks and AI Services

- Bot Frameworks
 - Botkit
 - Microsoft Bot Framework
 - Rasa NLU
- Al Services
 - –Wit.ai
 - -api.ai
 - LUIS.ai
 - -IBM Watson

Source: Igor Bobriakov (2018), https://activewizards.com/blog/a-comparative-analysis-of-chatbots-apis/

Chatbot Frameworks

Comparison Table of Most Prominent Bot Frameworks

	Botkit	Microsoft Bot Framework	
Built-in integration with messaging platforms	\odot	\otimes	\otimes
NLP support	(X) but possible to integrate with middlewares	(X) but have close bonds with LUIS.ai	\bigotimes
Out-of-box bots ready to be deployed	\odot	\otimes	\otimes
Programming Language	JavaScript (Node)	JavaScript (Node), C#	Python
			Created by ActiveWizards

Comparison of Most Prominent Al Services

	wit.ai	api.ai	LUIS.ai	IBM Watson				
Free of charge	\odot	but has paid enterprise version	it is in beta and has transaction limits	30 days trial then priced for enterprise use				
Text and Speech processing	\odot	\oslash	⊘ with use of Cortana	\odot				
Machine Learning Modeling	\odot	${ \oslash }$	${ \bigcirc }$	\odot				
Support for Intents, Entities, Actions	Solutions Intents used as trait entities, actions are combined operations	Solution Intents is the main prediction mechanism. Domains of entities, intents and actions	\bigotimes	\odot				
Pre-build entities for easy parsing of numbers, temperature, date, etc.	\odot	${ \bigcirc }$	${ \bigcirc }$	\odot				
Integration to messaging platforms	(X) web service API	So has facility for deploying to heroku. Paid environment	⊘ integrated to Azure	⊘ possible via API				
Support of SDKs	includes SDKs for Python, Node.js, Rust, C, Ruby, iOS, Android, Windows Phone	⊘ C#, Xamarin, Python, Node.js, iOS, Android, Windows Phone	© enables building with Web Service API, Microsoft Bot Framework integration	Proprietary language "AlchemyLanguage"				
Created by ActiveWizards								

Source: Igor Bobriakov (2018), https://activewizards.com/blog/a-comparative-analysis-of-chatbots-apis/

IMTKU System Architecture for NTCIR-13 QALab-3





NTCIR-13 Conference, December 5-8, 2017, Tokyo, Japan

System Architecture of

Intelligent Dialogue and Question Answering System





NTCIR-14 Conference, June 10-13, 2019, Tokyo, Japan



NTCIR-14 Conference, June 10-13, 2019, Tokyo, Japan



NTCIR-14 Conference, June 10-13, 2019, Tokyo, Japan






Short Text Conversation Task (STC-3) Chinese Emotional Conversation Generation (CECG) Subtask

Source: http://coai.cs.tsinghua.edu.cn/hml/challenge.html

NTCIR Short Text Conversation STC-1, STC-2, STC-3

		Japanese	Chinese	English		
NT	CIR-12 STC-1 22 active participants	Twitter, Retrieval	Weibo, Retrieval			Single-turn,
NT	CIR-13 STC-2 27 active participants	Yahoo! News, Retrieval+ Generation	Weibo, Retrieval+ Generation			Non task-oriented
NTCIR-14 STC-3 Chinese Emotional Converse Generation (CECG) subta		al Conversation ECG) subtask	Weibo, Generation for given emotion			
Dialogue Quality (DQ) and Nugget		categories Weibo+English translations, distribution estimation for		J	Multi-turn, task-oriented (helpdesk)	
			subjective annotations			

Source: https://waseda.app.box.com/v/STC3atNTCIR-14

Dialogue on **Airline Travel Information System** (ATIS)

The ATIS (Airline Travel Information System) Dataset

https://www.kaggle.com/siddhadev/atis-dataset-from-ms-cntk

Sentence	what	flights	leave	from	phoenix	
Slots	0	0	0	0	B -fromloc	
Intent	atis_flight					

Training samples: 4978 Testing samples: 893 Vocab size: 943 Slot count: 129 Intent count: 26

Source: Haihong, E., Peiqing Niu, Zhongfu Chen, and Meina Song. "A novel bi-directional interrelated model for joint intent detection and slot filling." In Proceedings of the 57th Annual Meeting of the Association for Computational Linguistics, pp. 5467-5471. 2019.

SF-ID Network (E et al., 2019) Slot Filling (SF) Intent Detection (ID)

A Novel Bi-directional Interrelated Model for Joint Intent Detection and Slot Filling



Source: Haihong, E., Peiqing Niu, Zhongfu Chen, and Meina Song. "A novel bi-directional interrelated model for joint intent detection and slot filling." In Proceedings of the 57th Annual Meeting of the Association for Computational Linguistics, pp. 5467-5471. 2019.

Intent Detection on ATIS State-of-the-art

Intent Detection on ATIS



						Con
RANK	METHOD	ACCURACY	PAPER TITLE	YEAR	PAPER	CODE
1	SF-ID	0.9776	A Novel Bi-directional Interrelated Model for Joint Intent Detection and Slot Filling	2019	•	0
2	Capsule-NLU	0.950	Joint Slot Filling and Intent Detection via Capsule Neural Networks	2018		0

Source: https://paperswithcode.com/sota/intent-detection-on-atis

Z Edit



Source: https://paperswithcode.com/sota/slot-filling-on-atis

Al Humanoid Robo-Advisor

Al Humanoid Robo-Advisor for Multi-channel Conversational Commerce



System Architecture of Al Humanoid Robo-Advisor



Conversational Model (LINE, FB Messenger)

Awaren Hi there! I want some info about stock how's goi Awaren Why do you want INFO ABOUT STOCK? Hi there! To get personal recommendations I am doing very well. How are you ?	hi ng
Why do you want INFO ABOUT STOCK? Hi there! I am doing very well. How are you ?	
What you said was too America are you ?	
complicated for me.	
Price 2330 TSMC	elp
 2330台積電各項資訊如下: 市價:233.0 買價:233.5 成交量:30,664 前日收盤價:229.5 開盤:232.5 最高:234.0 	
	ഹ

Conversational Robo-Advisor Multichannel UI/UX Robots





ALPHA 2





Portfolio Performance in 2016 Annual Portfolio Statistics

	Black-Litterman Portfolio - the LSTM Investor Views	Markowitz Portfolio	Equally Weighted Portfolio	S&P 500 Index
Annual return	16.151%	15.172%	12.428%	9.643%
Annual volatility	13.897%	14.365%	15.870%	13.169%
Sharpe ratio	1.14697	1.05534	0.81762	0.76492
Stability	0.82500	0.82515	0.82514	0.78754
Max drawdown	-10.105%	-10.465%	-12.529%	-10.306%
Skew	-0.35652	-0.52985	-0.56976	-0.36795
Kurtosis	2.49845	3.00613	2.41894	2.21958
Daily value at risk	-1.688%	-1.750%	-1.948%	-1.619%
Alpha	0.06445	0.05354	0.02158	0.00000
Beta	1.01485	1.04816	1.15631	1.00000
Information ratio	0.10935	0.09129	0.04655	_

Source: Min-Yuh Day, Tun-Kung Cheng and Jheng-Gang Li (2018), "AI Robo-Advisor with Big Data Analytics for Financial Services", in Proceedings of the 2018 IEEE/ACM International Conference on Advances in Social Networks Analysis and Mining (ASONAM 2018), Barcelona, Spain, August 28-31, 2018.

Portfolio Cumulative Returns

Cumulative Returns: Portfolios



Source: Min-Yuh Day, Tun-Kung Cheng and Jheng-Gang Li (2018), "Al Robo-Advisor with Big Data Analytics for Financial Services", in Proceedings of the 2018 IEEE/ACM International Conference on Advances in Social Networks Analysis and Mining (ASONAM 2018), Barcelona, Spain, August 28-31, 2018.

Cumulative Returns Markowitz v.s. Black-litterment



Source: Min-Yuh Day, Jian-Ting Lin and Yuan-Chih Chen (2018), "Artificial Intelligence for Conversational Robo-Advisor", in Proceedings of the 2018 IEEE/ACM International Conference on Advances in Social Networks Analysis and Mining (ASONAM 2018), Barcelona, Spain, August 28-31, 2018

Summary

- Al Robo-Advisor in FinTech
- Chatbot for Conversational Commerce
- Al Humanoid Robo-Advisor

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